

ENHANCED VISUALIZATION OF BREATHING OR HEARTBEAT OF AN INFANT OR OTHER MONITORED SUBJECT

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application is related to U.S. patent application Ser. No. 15/859,650, entitled “INFANT MONITORING SYSTEM WITH VIDEO-BASED TEMPERATURE BASELINING AND ELEVATED TEMPERATURE DETECTION” filed Dec. 31, 2017, which is hereby incorporated by reference in its entirety for all purposes.

This patent application is also related to U.S. patent application Ser. No. 15/859,654, entitled “INFANT MONITORING SYSTEM WITH OBSERVATION-BASED SYSTEM CONTROL AND FEEDBACK LOOPS” filed Dec. 31, 2017, which is hereby incorporated by reference in its entirety for all purposes.

TECHNICAL FIELD

This patent specification relates generally to a smart-home environment for monitoring subject. More particularly, this patent specification describes automatic control of smart-home devices, such as video camera assemblies, keypads, security system sensors, thermostats, hazard detectors, doorbells, and/or the like, to create and/or monitor an optimal sleep environment for a monitored subject.

BACKGROUND

Smart-home devices are rapidly becoming part of the modern home experience. These devices may include thermostats, keypads, touch screens, and/or other control devices for controlling environmental systems, such as HVAC systems or lighting systems. The smart-home environment may also include smart appliances, such as washing machines, dishwashers, refrigerators, garbage cans, and so forth, that interface with control and/or monitoring devices to increase the level of functionality and control provided to an occupant. Security systems, including cameras, keypads, sensors, motion detectors, glass-break sensors, microphones, and so forth, may also be installed as part of the smart-home architecture. Other smart-the home devices may include doorbells, monitoring systems, hazard detectors, smart lightbulbs, and virtually any other electronic device that can be controlled via a wired/wireless network.

Many modern smart-home environments may include video cameras. These video cameras may be used for security systems, monitoring systems, hazard detection systems, and so forth. In general, video cameras provide a live video feed that can be played at a local console or on a computing system of the user, allowing them to remotely monitor a portion of the smart-home environment or its surroundings.

BRIEF SUMMARY

In some embodiments, a method of monitoring physical characteristics of subjects in sleep environments may include receiving, through a video camera, a video feed of a subject in a sleep environment. The method may also include analyzing the video feed of the subject to identify motion of the subject in the video feed. The method may additionally include causing a mobile device to present a

representation of the motion of the subject, wherein the motion of the subject is exaggerated.

In some embodiments, a system for monitoring physical characteristics of subjects in sleep environments may include a video camera, one or more processors, and one or more memory devices comprising instructions that, when executed by the one or more processors, cause the one or more processors to perform operations that may include receiving, through a video camera, a video feed of a subject in a sleep environment. The operations may also include analyzing the video feed of the subject to identify motion of the subject in the video feed. The operations may additionally include causing a mobile device to present a representation of the motion of the subject, wherein the motion of the subject is exaggerated.

A further understanding of the nature and advantages of the present invention may be realized by reference to the remaining portions of the specification and the drawings. Also note that other embodiments may be described in the following disclosure and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an example of a smart-home environment within which one or more of the devices, methods, systems, services, and/or computer program products described further herein will be applicable, according to some embodiments.

FIG. 2A illustrates a simplified block diagram of a representative network architecture that includes a smart-home network in accordance, according to some embodiments.

FIG. 2B illustrates a simplified operating environment in which a server system interacts with client devices and smart devices, according to some embodiments.

FIG. 3 illustrates a block diagram of a representative smart device in accordance with some implementations.

FIG. 4A illustrates a view of a representative camera assembly in accordance with some implementations.

FIG. 4B illustrates a view of a representative camera assembly in accordance with some implementations.

FIG. 5A is an expanded component view of a representative camera assembly in accordance with some implementations.

FIG. 5B is an expanded component view of a representative camera assembly in accordance with some implementations.

FIG. 6 illustrates an infant sleeping in a sleep environment and being monitored by a camera, according to some embodiments.

FIG. 7 illustrates a view of the infant that may be received by the camera, according to some embodiments.

FIG. 8 illustrates a view of the infant with a bounding box that reduces the processing power, memory, and/or bandwidth required by the system, according to some embodiments.

FIG. 9A illustrates a representation of the motion detection analysis that may be performed on each image frame in the live video feed, according to some embodiments.

FIG. 9B illustrates a set of pixels illustrating a relative displacement of pixels in the image of the infant, according to some embodiments.

FIG. 10 illustrates a system diagram for processing and transmitting images between the camera and a user's mobile device, according to some embodiments.

FIG. 11 illustrates a representation of the live video feed displayed on a mobile device, according to some embodiments.